DRAFT

INITIAL GROUNDWATER CONDITIONS WORK PLAN

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PREPARED FOR:

Atlantic Richfield Company
307 EAST PARK STREET, SUITE 400
ANACONDA, MONTANA 59711

PREPARED BY:

BROWN AND CALDWELL

3264 Goni Rd, Suite 153
Carson City, Nevada 89706
(775) 883-4118

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SECTION 1.0
INTRODUCTION

Atlantic Richfield Company has prepared this Draft Initial Groundwater Conditions Work Plan ("Work Plan") to conduct initial investigations that would assist in evaluating potential ecological and human health risks associated with mine-related groundwater resulting from historic mining, milling and leaching operations at the Yerington Mine Site. The area north and west of the mine site is the focus of this initial investigation because recent sampling of domestic wells indicates that uranium concentrations in groundwater locally exceed the maximum contaminant level (MCL) of 30 micrograms per liter (ug/L). Investigations proposed in this Work Plan would be conducted pursuant to the Quality Assurance Project Plan (QAPP; Brown and Caldwell, 2002b). The following communications between Atlantic Richfield and the U.S. Environmental Protection Agency (EPA), Nevada Division of Environmental Protection – Bureau of Water Pollution Control (NDEP) and the U.S. Bureau of Land Management (BLM) have resulted in this Work Plan:.

- October 26, 2004 letter from Atlantic Richfield to NDEP entitled: Proposed Groundwater Investigations for the Yerington Mine Site;
- EPA Preliminary Response to Comments on the Proposed Offsite Groundwater Investigation;
- November 24, 2004 letter from Atlantic Richfield to NDEP entitled: Response to Comments on Proposed Groundwater Investigations for the Yerington Mine Site; and
- Teleconference between Atlantic Richfield, EPA, BLM, NDEP and other members of the Yerington Technical Work Group.

Initial groundwater investigations conducted as part of this Work Plan would provide the basis for developing an improved conceptual hydrogeologic model for the area around the mine site and, subsequently, a more comprehensive Groundwater Conditions Work Plan. Initial and subsequent groundwater investigations would address the Data Quality Objectives (DQOs) described in the *Draft Final Groundwater Conditions Work Plan* (Brown and Caldwell (2003a). Modified DQOs for proposed initial groundwater investigations are presented in Section 2.0 of this Work Plan.

1.1 Location

The Yerington Mine Site is located west and northwest of the town of Yerington in Lyon County, Nevada (Figure 1). The Walker River flows northerly and northeasterly past the mine site, between the site and the town of Yerington. The river is within a quarter-mile of the southern portion of the site, and the distance between the site and the river increases to the north. Highway 95A is also located between the mine site and the town of Yerington (Figure 1). The Paiute Tribe Indian Reservation is located approximately 2.5 miles north of the site.

The Yerington Mine Site is located in Mason Valley and the Mason Valley hydrographic basin (no. 108) within the Walker River watershed. Agriculture has been the principal economic activity in Mason Valley (principally hay and grain farming, with some beef and dairy cattle ranching). Local onion farming is also present in the area. Surface water diversions from the Walker River and groundwater pumping provide the irrigation water for these agricultural activities. Agricultural irrigation immediately north of the mine site is anticipated to significantly influence groundwater flow conditions.

1.2 Past Mining Operations and Current Conditions

Mining, milling and leaching operations for oxide and sulfide copper ores from an open-pit in the southern portion of the mine site were conducted between 1953 and 1978 by Atlantic Richfield's predecessor, the Anaconda Mining Company. Waste rock piles were constructed to the south and to the north of the open pit. Tailings impoundments and process solution evaporation ponds were constructed north of the pit and the mill/precipitation plant areas. The milling process for oxide and sulfide ores varied. Oxide ores were crushed and vat-treated with sulfuric acid that was produced from an on-site Acid Plant. The resulting copper sulfate solution was decanted and the remaining solids were placed in the tailings ponds. The copper sulfate solution was subjected to "iron laundering" in which the copper in solution exchanged with iron, resulting in a copper precipitate. Residual solutions, containing elevated concentrations of iron and sulfate, were conveyed to evaporation ponds at a rate of about 700 gpm (Seitz et. al., 1982).

Sulfide ores were finely crushed, and copper sulfides were recovered using a flotation process with the addition of lime to achieve a neutral pH. Residual solids were then placed in the sulfide tailings ponds. Copper concentrates from the milling process were dried and shipped off-site for smelting. Fine-grained tailings were transported to the ponds as a slurry, and the liquid fraction was recycled for use in further milling. Seepage from the northernmost tailings pond was collected in a peripheral ditch and recycled along with the liquid fraction of the tailings fluid. During mining and milling operations, the tailings deposition areas and associated evaporation ponds and containment ditches were progressively expanded to the north to accommodate the need for increased tailings capacity. Given the mineralogical characteristics of the ore and waste rock mined from the Yerington open pit, naturally-occurring radioactive minerals appear to have been concentrated in portions of the tailings areas and evaporation ponds.

Arimetco, Inc. acquired the property in 1989, and initiated leaching operations at five lined leach pads located around the site (Figure 2), including the re-handling and leaching of previously deposited waste rock north of the pit. Arimetco also constructed and operated an electro-winning plant with associated solution ponds located south of the former mill area (Figure 2). Some Arimetco leach pads and solution ponds were constructed on the pre-existing oxide tailings areas. Arimetco ceased mining new ore and leaching operations in November 1998, and continued to recover copper from the heaps until November 1999 (Joe Sawyer, SRK; written comm.., 2003). Since the end of mining and leaching operations by Arimetco in 1996 to the present, the State of Nevada has managed heap process fluids by re-circulation and evaporation.

Beginning in 1986, Atlantic Richfield managed groundwater by installing and operating a pumpback well system located along the northwestern margin of the mine site. Lined pumpback evaporation ponds were constructed in 1986 to evaporate mine-related groundwater at the site. Past mining and ore processing activities at the Yerington Mine have created the current site conditions, with the mine units and process areas shown in Figure 2. The following mine units may be potential sources of constituents of concern (COCs) to groundwater via leaching of surface materials by meteoric water and infiltration through the unsaturated (vadose) zone:

Tailings Areas

- Oxide (Vat Leach) Tailings
- Sulfide Tailings

Waste Rock Areas

- South Waste Rock Area
- North Waste Rock Areas

Evaporation and Recycling Ponds

- North, Middle and South Lined Evaporation Ponds
- Finger Evaporation Ponds
- Unlined Evaporation Pond
- Lined Evaporation Pond (South, Middle and North)
- Pumpback Evaporation Pond
- Process Solution Recycling Ponds

Leach Pads

- Phase I Heap Leach Pad
- Phase II Heap Leach Pad
- VLT Heap Leach Pad
- Slot Heap Leach Pad

Process Areas

- Buildings
- Shops
- Fuel Storage Areas
- Ponds and other structures

Arimetco Electrowinning Facilities

- Electro-winning Plant
- Ponds and other structures
- Pipelines, ditches and other conveyances

Ancillary Mine Units

- Landfills
- Sewage Treatment Ponds
- Pipelines, ditches and other conveyances

Groundwater conditions associated with the Process Areas are currently being investigated under a separate Work Plan.

1.3 Hydrogeologic Setting

This section describes the general hydrogeologic conditions in the area surrounding the Yerington Mine Site, based on the following previous studies:

- Huxel, C.J., Jr., 1969, *Water Resources and Development in Mason Valley, Lyon and Mineral Counties, Nevada, 1948-1965*, Nevada Division of Water Resources Water Resources Bulletin No. 38 prepared in cooperation with the U.S. Geological Survey (this is a comprehensive hydrologic study of the Mason Valley area including water budgets and effects of agriculture on surface and groundwater quality and quantity).
- Seitz, Harold, Van Denburgh, A.S. and La Camera, Richard J., 1982, *Ground Water Quality Downgradient from Copper Ore Milling Wastes at Weed Heights, Lyon County, Nevada*, U.S. Geological Survey Open File Report 80-1217 (this study presents hydrologic and geochemical data on the effects of mining on groundwater quality from a number of monitor wells, most of which are no longer operational).
- Proffett, J.M., Jr., and Dilles, J.H., 1984, *Geologic Map of the Yerington District, Nevada*, Nevada Bureau of Mines and Geology, Map 77.
- Dalton, Dennis, 1999, *Arimetco Yerington Mine and Process Facility Site Assessment of Groundwater Quality*, consultant report prepared for Arimetco, Inc. for submittal to NDEP (interpretations of data presented in this report allege that potential impacts from Arimetco operations could not be distinguished from pre-existing impacts from Anaconda operations).
- Piedmont Engineering, 2001, *Yerington Shallow Aquifer Data Evaluation Report*, consultant prepared for ARCO, March 20, 2001 (interpretations of data presented in this report support specific working hypotheses to be verified.
- Applied Hydrology Associates, 1983, *Evaluation of Water Quality and Solids Leaching Data,* consultant report prepared for Anaconda Minerals Company, May 25, 1983 (interpretations of groundwater data are compared to the Seitz et. al. report; this report includes surface water and solids leaching data in addition to groundwater sampling).
- Applied Hydrology Associates, *Annual Monitoring and Operation Summary: Pumpback Well System, Yerington Nevada,* annual consultant reports prepared for Atlantic Richfield Company provides groundwater elevation and water quality data for the pumpback and associated monitor wells; also includes pumping rates and time-concentration plots for select constituents; this report helps to interpret the effectiveness of the pumpback well system in limiting down-gradient migration of impacted groundwater).

The Yerington Mine site is located on the west side of Mason Valley, a structural basin surrounded by the mountain ranges described above. The area is typical of basin-and-range topography. The mountain blocks are primarily composed of granitic, metamorphic and volcanic rocks with minor amounts of semi-consolidated to unconsolidated alluvial fan deposits. The

Singatse Range has been subject to metals mineralization, as evidenced by the large copper porphyry ore deposit at the Yerington Mine. Proffett and Dilles (1984) published a geologic map of the Yerington District that describes these features.

Unconsolidated alluvial deposits derived by erosion of the uplifted mountain block of the Singatse Range and alluvial materials deposited by the Walker River fill the structural basin occupied by Mason Valley in the vicinity of the mine site. These unconsolidated deposits, collectively called the valley-fill deposits by Huxel (1969), comprise four geologic units: younger alluvium (including the lacustrine deposits of Lake Lahontan), younger fan deposits, older alluvium and older fan deposits. Lake Lahontan lacustrine deposits appear to have been removed and reworked by the Walker River as it meandered back and forth across the valley Huxel (1969). Huxel estimated that Pleistocene Lake Lahontan in Mason Valley persisted for a relatively short time, and was less than 60 feet deep.

Seitz et. al. (1982) described the geologic setting of the area around the mine site based on existing information and the sub-surface information obtained through the drilling of test (i.e., monitor wells) north of the site by the U.S. Geological Survey in 1978. Alluvial fan deposits along the west margin of the valley and stream- and lake-deposited materials on the valley floor underlie the tailings and evaporation ponds.

Atlantic Richfield installed two shallow monitor wells (MW-2002-1 and MW-2002-2) in the area north and northwest of the mine site in June 2002. These wells were drilled with a core rig to collect detailed lithologic information from the shallow alluvial aquifer. Core samples generally consisted of a relatively uniform mix of fine-grained sand, silt and clay size fractions with little internal structure (i.e., bedding, laminations, etc.). The exception to the homogeneous character of the core samples occurred immediately above and at the depth where groundwater was intersected in one of the boreholes. At this horizon, fine clay laminations with minor folding or "slump" features were observed. Samples just above the top of the water table in both monitor well boreholes generally contained higher clay contents than those below.

SECTION 2.0
DATA QUALITY OBJECTIVES

The Data Quality Objectives (DQOs) for the initial evaluation of groundwater conditions presented in this Work Plan include the collection of appropriate data to support a future assessment of: 1) ecological and human health risks associated with mine-related groundwater that may have migrated off-site, and the potential for additional constituents of concern (COCs) to migrate to potential down-gradient receptors; and 2) management alternatives for limiting or preventing continued flow of mine-related groundwater flow to potential down-gradient receptors. In order to ensure that hydrogeologic and chemical data of sufficient quality and quantity are collected during the field activities described in this Work Plan, the following seven-step DQO process is presented:

- Step 1. State the Problem – Describe the problem and identify the resources available to resolve the problem;
- Step 2. Identify the Decision – Identify the questions that the study would attempt to answer;
- Step 3. Inputs to the Decision – Identify the information needed to support the decision and the measurements that need to be taken to resolve the decision statement;
- Step 4. Define the Boundaries of the Study – Specify the spatial and temporal aspects of the environmental media that the data must represent to support the decision;
- Step 5. Develop a Decision Rule – Develop unambiguous "If…then" statements that define the conditions that would trigger one of the alternative actions;
- Step 6. Specify the Limits on Decision Factors – Specify the acceptable limits on decision errors, which are used to establish performance goals for limiting uncertainty in the data; and
- Step 7 Optimize the Design for Obtaining Data – Identify the most resource-effective sampling and analysis design for generating data that are expected to satisfy the DQOs.

The problem statement (Step 1) is as follows: "Groundwater conditions in the area of the Yerington Mine Site, including the areas west and north of the mine site with domestic wells uranium concentrations that exceed the MCL, are not completely known, and available information is inconclusive with respect to the source, transport pathways and fate of COCs in groundwater that may pose a risk to human health and the environment".

Step 2 of the DQO process (Identify the Decision) asks the key question(s) that this Work Plan attempts to address: "What initial borehole characterization, monitor well installation, sampling and analytical activities for selected locations around the Yerington Mine Site would: 1) improve understanding of the conceptual hydrogeologic model of the groundwater flow system at the site; 2) support an evaluation of the potential risk to the environment and human health; and 3) support the development and evaluation of groundwater management alternatives and ties at the groundwater protection goals?" The criteria necessary to determine if the proposed initial characterization activities would answer this question include, but may not be limited to:

- Adequacy of collected data to initially document the fate and transport of COCs in the groundwater flow systems associated with the Site at present, and COCs that may be sourced from surface mine units in the future;
- Adequacy of collected data to initially define "background" or "ambient" chemical concentrations in groundwater hydrologically up-gradient of the mine;
- Adequacy of collected data to initially document the efficiency of the existing pumpback well system to capture COCs that may be migrating to possible receptors located down-gradient of the Site; and
- Adequacy of collected data to initially document the effects of agricultural activities at the northern margin of the Site on ground water flow and solute transport.

Step 3 of the DQO process (Identify the Inputs to the Decision) identifies the kind of initial groundwater information that is needed to address the question posed under Step 2. This information would include:

- Three-dimensional lithologic and geochemical information, including background conditions, for the alluvial aquifer that supplies drinking water to domestic wells located north and west of the mine site;
- Groundwater elevation and groundwater quality data obtained through measurements and sampling of a three-dimensional array of groundwater monitor wells in the alluvial aquifer located north and west of the mine site;
- The response in selected portions of the alluvial aquifer to agricultural pumping and irrigation practices; and
- Groundwater elevation data in properly constructed piezometers associated with selected pumpback wells to assess the effectiveness of the pumpback well system in limiting the off-site migration of mine-related groundwater.

Step 4 of the DQO process (Define the Boundaries of the Study) defines the spatial and temporal aspects of the field monitoring, sampling and analytical activities proposed in this Work Plan. The area for the initial groundwater investigations described in this Work Plan is shown in Figure 2. The time frame for conducting the initial field activities described in this Work Plan would be March through September 2005. Monitor well installations would be completed in two steps as part of this Work Plan: 1) the first step would be in conjunction with the drilling of the stratigraphic boreholes; and 2) the second step would be performed after groundwater quality data is received from the analytical laboratory following depth-specific sampling in the boreholes. A Data Summary Report would be available within three months of receiving all data from the analytical laboratory, including groundwater sample results from "second-step" monitor wells. This temporal framework for the proposed groundwater investigations is dependent upon Atlantic Richfield receiving timely approval of this Work Plan, and permission to drill the boreholes from various land owners.

The initial groundwater investigations described in this Work Plan would be the first phase of a phased groundwater investigation program. Subsequent phases would be developed after the results presented in the Data Summary Report are reviewed by the EPA and Atlantic Richfield.

Step 5 of the DQO process (Develop a Decision Rule) determines if the proposed data collection activities would be of sufficient quantity and quality to satisfy the DQOs. Given that EPA hydrogeologists participated in the development of this Work Plan, Atlantic Richfield anticipates that the field data and analytical results would achieve data adequacy standards.

Step 6 of the DQO process (Specify the Limits on Decision Errors) would be based on measurement errors, rather than sampling errors, given that measurement errors would likely be the primary factors affecting any decision error. Laboratory-validated data would be required to limit measurement errors. Sampling errors would be limited, to the extent practicable, by following the procedures described in this Work Plan and in the Quality Assurance Project Plan (Brown and Caldwell, 2003b), along with EPA guidelines.

Step 7 of the DQO process (Optimize the Design for Obtaining Data) has been accomplished through EPA involvement in the development of this Work Plan. Atlantic Richfield anticipates that the initial groundwater investigations described in this Work Plan would result in subsequent groundwater investigation phases that, because of this iterative approach, would provide the most resource-effective sampling and analysis design.

The DQOs listed above and the associated field and laboratory activities presented in this Work Plan represent an initial phase of groundwater investigations associated with the Yerington Mine Site. Subsequent to the activities described in this Work Plan, Atlantic Richfield anticipates that additional groundwater investigation activities would be conducted including, but not limited to:

- Geophysical logging of a select number of monitor wells constructed in the deep zone of the alluvial aquifer to determine the effectiveness of in-casing techniques for implementation at other deep installations.
- Aquifer testing associated with the irrigation supply well and, potentially, other locations north of the mine site.
- Geotechnical characterization of selected borehole materials, pending further discussion with the Yerington Technical Work Group.
- Additional stratigraphic borehole drilling and monitor well construction, and additional piezometer construction as required.

SECTION 3.0
WORK PLAN

This Work Plan describes initial groundwater investigation activities designed to achieve the DQOs presented in Section 2.0. Implementation of this Work Plan would provide: 1) stratigraphic, aquifer material characteristics and groundwater quality data that would supplement existing site monitor well and domestic well data; 2) a three-dimensional view of groundwater conditions north of the mine site; 3) groundwater flow information; and 4) the basis to conduct subsequent investigations. Subsequent investigations would include a detailed assessment of the effects of irrigation practices on groundwater flow and quality, aquifer testing, additional monitor well installations, and a characterization of natural background populations of groundwater chemistry corresponding to the complexity of the hydrogeologic setting and groundwater flow system. The activities to be performed during the initial investigations, described in this Work Plan, include:

- Borehole drilling and stratigraphic logging;
- Depth-discrete groundwater sampling and analysis;
- Monitor well design and installation;
- Monitor well development and surveying;
- Groundwater sampling and analysis; and
- Piezometer and data logger installation.

Borehole drilling would be conducted using a Water Development Corporation (WDC) sonic core drilling rig to obtain a continuous, relatively undisturbed core of the alluvium for stratigraphic logging. The proposed total depths below ground surface (bgs) for the stratigraphic boreholes are described below and would be consistent with, and representative of, nearby domestic wells. At each borehole location, depth-specific groundwater samples would be collected for the measurement of field parameters and the submittal to an analytical laboratory for selected chemical analyses.

A groundwater monitor well would be constructed in each of the stratigraphic boreholes. The 20-foot screen for the first groundwater monitor well would be constructed at the deepest interval designated in the borehole, based on the collection of field data described below. Subsequently, one or two additional (i.e., "second-step") monitor wells would be constructed immediately adjacent to the first monitor well (i.e., within 20 feet). The monitor well designs would be based on: 1) an evaluation of the stratigraphic information encountered during drilling; 2) the depth-specific field parameter data; and 3) the screen intervals of nearby domestic wells, including those with elevated uranium concentrations. In addition, designs of the "second-step" wells would be based on the results of laboratory analytical results from the depth-specific samples.

Once constructed, monitor wells would be developed and surveyed. After development, groundwater samples would be collected from the monitor wells for laboratory analysis, as described below. In addition to the stratigraphic borehole and monitor well installation program, a piezometer (i.e., observation well) would be installed adjacent to pumpback well PW-3 and a second piezometer adjacent to pumpback well PW-10, to help evaluate the capture zones around pumpback wells with relatively high and low pumping rates. Piezometer construction would be consistent with the construction of the pumpback wells and would be located within five feet of each pumpback well. Data loggers would be installed in the piezometers to collect continuous groundwater elevation measurements in association with pumping rates and volumes.

Additional phased investigations of groundwater conditions are anticipated to be completed upon review of the data collected during the activities described in this Work Plan. All field and analytical results from the activities described in this Work Plan would be presented in a Data Summary Report.

3.1 Borehole Drilling and Data Collection

To provide a conceptual framework for the initial groundwater investigations proposed in this Work Plan, including the depth and locations of proposed stratigraphic boreholes, a north-south cross-section extending from the mine site to the Sunset Hills area was developed (Figure 3). The cross-section shows: 1) available lithologic information including the occurrence of subsurface clay horizons that may define shallow, intermediate and deep stratigraphic zones; 2) proposed locations and depths for selected boreholes, and approximate monitor well screen intervals along the line of the section; and 3) domestic wells along the line of the section. Note that some existing domestic wells shown in Figure 3 are projected onto the plane of the cross-section. Figure 3 represents a preliminary conceptual hydrogeologic model for the alluvial aquifer immediately north of the mine site. Similar concepts, as schematically shown in Figure 4, have been presented in the *Conceptual Site Model for the Yerington Mine Site* (Brown and Caldwell, 2002b) and the *Draft Final Groundwater Conditions Work Plan* (Brown and Caldwell, 2003). In addition to the cross-section shown in Figure 3, domestic well construction data and associated groundwater quality were evaluated to design the proposed borehole and monitor well installation program.

Borehole Depths and Locations

Proposed depths for the stratigraphic boreholes generally range from 150 to 240 feet bgs, except where bedrock may be encountered at a more shallow depth. Proposed borehole depths are based on available well construction information for domestic wells, and the occurrence of uranium concentrations that exceed the MCL in the domestic wells. Tables 1 and 2 present construction information for selected domestic wells located in the Sunset Hills and the Luzier Lane/Locust Lane areas, respectively. Surface elevations for the domestic wells provided in Tables 1 and 2 were estimated using available aerial photography and topography for the mine site. Available well construction data were used in conjunction with these surface elevations to estimate the domestic well screen intervals. The proposed depths of the stratigraphic boreholes are presented in Table 3, based on the information presented in Tables 1 and 2.

Proposed borehole and monitor well construction locations are shown in Figures 2 and 5 as B/W designations (Figure 5 provides a more detailed view of the proposed wells located west and north of the mine site). These locations were selected in conjunction with EPA hydrogeologists to evaluate groundwater conditions: 1) in the areas of domestic wells with documented uranium concentrations that exceed the 30 ug/L MCL; 2) at two locations associated with agricultural operations immediately north of the mine site, including a site adjacent to an irrigation well that pumps significant volumes of groundwater on a seasonal basis; 3) at a location within the northern portion of the mine site approximately 750 north of existing site monitor well (MW-05) with documented concentrations of uranium that exceed the MCL; and 4) potential areas that would represent background groundwater quality characteristics south of the mine site and west of the domestic wells of concern. Table 3 also summarizes the site selection criteria for the boreholes and wells.

In the Sunset Hills area, all of the domestic wells with screen intervals extend less than 180 feet bgs. As a result, groundwater from these domestic wells, including those with uranium concentrations above the MCL, is collected from elevations above 4,200 feet (above mean sea level) amsl. Therefore, stratigraphic boreholes B/W-4 and B/W-10 in the Sunset Hills area would be drilled to a depth of 200 feet bgs.

In the Locust Lane area, screen intervals in domestic wells DW-71 and DW-72 extend to 233 and 239 feet bgs, respectively, corresponding to elevations of 4,237 to 4,257 feet amsl for DW-71, and from 4,239 to 4,259 feet amsl for DW-72. Therefore, stratigraphic borehole B/W-6 would be drilled to approximately 240 feet bgs (approximately 4,236 feet amsl) or until it encounters bedrock, which ever is less..

Other domestic wells in these areas indicate that uranium concentrations above the 30 ug/L MCL also occur at elevations above 4,200 feet amsl. Therefore, stratigraphic boreholes B/W-2, B/W-3, B/W-5 and B/W-9 would be drilled to a depth of 150 feet bgs, given that ground surface elevations at these sites are all approximately 4,350 feet amsl. Because stratigraphic boreholes B/W-7 and B/W-8 are located adjacent to the Singatse Range, where ground surface elevations are slightly higher than the central portion of the Mason valley, these boreholes would be drilled to a depth of approximately 200 feet bgs, or until they encounter bedrock.

In the Luzier Lane area, irrigation well WDW019 extends to a depth of 365 feet bgs and has a 315-foot long screen interval. Groundwater pumped from this well would likely represent yields from the shallow, intermediate and deep zones in the alluvial aquifer. Therefore, stratigraphic borehole B/W-1 would be drilled to a depth of 200 feet bgs to ensure that the shallow, intermediate and deep zones are evaluated.

Borehole B/W-11, located on the mine site, would be drilled to a depth of 200 feet bgs to evaluate groundwater quality throughout the stratigraphic sequence depicted in Figure 3, and the potential for COCs to vertically migrate to depth beneath the area of evaporation ponds. Boreholes B/W-12 and 13, generally located south of the mine site to assess potential background water quality, would be drilled to a depth between 150 and 200 feet bgs. This uncertainty is associated with limited groundwater and depth-to-bedrock information in this area. If bedrock is encountered at depths less than 150 feet bgs in these areas, the boreholes would be terminated at the alluvium-bedrock contact and the monitor wells would be constructed above the contact.

Drilling and Sampling Methods

Stratigraphic boreholes would be advanced using the roto-sonic drilling technique, which employs simultaneous high frequency vibration and low speed rotational motion along with downward pressure to advance the core barrel. A 4-inch diameter, 5-foot long core barrel is first advanced five feet into the ground, and is followed by a 6-inch override casing drilled to the same depth as the core barrel cutting shoe. The core barrel is then removed and the 5-foot soil core is extruded into plastic sleeves. The core barrel is then sent back down into the hole where it is advanced another 5 feet followed again by the override casing. The outer casing prevents cross-contamination and formation mixing, and allows for controlled placement of temporary well screens and pumps for sampling, and down-hole instrumentation.

Upon collection, the soil core would be described using the American Society of Testing and Materials (ASTM; 1992) Standard D 2487-92 – Classification of Soils for Engineering Purposes (Unified Soil Classification System). Core samples would be archived at the mine site in plastic containers to preserve their soil texture.

Groundwater samples would be collected from each borehole location to: 1) obtain depth-specific chemical data (field data for the initial deep monitor well and laboratory analytical data for co-located shallow and or intermediate monitor wells) that, in conjunction with lithologic logging, would assist in the design of the monitor well screen intervals; and 2) obtain laboratory analytical data to evaluate the vertical distribution of groundwater chemistry and, if present, COCs in groundwater. Depth-specific sampling would: 1) provide a three-dimensional picture of groundwater conditions north of the mine site; 2) improve the site conceptual hydrogeochemical model; and 3) assist in the evaluation of spatial heterogeneity and contaminant transport parameters in the groundwater flow system.

At least 10 depth-specific ground water samples would be collected per borehole (the maximum interval between groundwater screening samples would be 20 feet). In addition to nominal 15-foot or 20-foot intervals in each borehole, sampling intervals would be based on lithologic information collected during drilling and the construction of nearby domestic wells, as follows:

- Within the first five feet immediately beneath the first encountered water table
- At the bottom of the shallow (hydrostratigraphic) zone above the first clay horizon
- At the first transmissive zone immediately below the first shallow clay horizon
- In the middle of the intermediate (hydrostratigraphic) zone, at elevations consistent with the screen intervals of nearby domestic wells and/or where transmissive zones are encountered
- At the bottom of the intermediate (hydrostratigraphic) zone
- At the first transmissive zone immediately below the deep clay
- At elevations consistent with the screen intervals of nearby domestic wells

A detailed description of groundwater sampling procedures using the roto-sonic core drill is provided below, and a schematic illustration of the casing/packer/pump assembly is presented in Appendix A. The alluvial formation would be cored using the 6-inch casing and the 4-inch sonic core barrel, and a 6-inch temporary casing would be advanced to the bottom of the cored interval, and a core sample would be obtained from the subjacent interval. At the designated interval in the aquifer, based on lithologic or other information, the 4-inch sonic core barrel would be advanced beyond the 6-inch temporary casing and the soil sample would be retrieved. A 3-inch diameter stainless steel screen and 3-inch diameter riser casing would be vibrated into the cored section of the borehole allowing the formation to collapse around the screen. A 3-inch by 6-inch K-packer would separate and center the 6-inch sonic casing and 3-inch riser.

A submersible pump would then be lowered into the riser and set in the screen. An inflatable packer is located above the pump on the pump drop/column pipe. The packer would be inflated, isolating the screen section and the depth-specific groundwater sample would be obtained after the appropriate volume of groundwater is purged. The packer would then be deflated and the pump removed from the 3-inch screen and riser. The screen and the 3-inch riser is vibrated from the formation. Temporary casing would then be advanced to the bottom of the sampled interval, and the operation would be repeated at the next interval to be sampled.

Groundwater samples would be collected using a peristaltic pump and dedicated lengths of small diameter polyethylene tubing for each discrete sampling interval. Subsequent to collecting the groundwater sample, the stainless steel screen would be decontaminated in accordance with the procedures specified in the QAPP (Brown and Caldwell, 2003), consistent with EPA guidelines (EPA, 1996 and 1992).

The parameter suite for the depth-specific groundwater screening samples would consist of: 1) field measurements of pH, conductivity, temperature, DO, oxidation-reduction potential (ORP), iron (un-speciated, or "total"), ferrous iron (Fe^{2+}), sulfate, nitrate and alkalinity; and 2) laboratory analysis of uranium (filtered and unfiltered), arsenic (filtered and unfiltered) and total organic carbon. These parameters and laboratory analyses are summarized in Table 4. Filtering would be performed using a 0.45 micron filter. Procedures for performing field analysis of total iron, ferrous iron, sulfate, nitrate and alkalinity are presented in Appendix B. A more detailed description of the laboratory analyses to be conducted as part of this Work Plan is described below.

3.2 Monitor Well and Piezometer Construction

As described above, screen intervals for the deep of monitor well installation in each borehole (termed "first-step" monitor wells in this Work Plan) would be based on: 1) lithologic information obtained during drilling; 2) field parameter measurements and analyses of the depth-specific groundwater samples obtained during drilling; and 3) available construction details for nearby domestic wells. Designs for "second-step" monitor wells to be constructed in the shallow and/or intermediate portions of the alluvial aquifer would be developed in consultation with EPA hydrogeologists, and would also be based on laboratory analytical results from the depth-specific groundwater samples collected during borehole drilling.

Lithologic information to be used in designing the monitor wells would include alluvial materials grain size, degree of sorting, visually estimated aquifer properties (i.e., transmissivity) and presence or absence of clay horizons that may serve as aquitards. Screen intervals would also be based on: 1) field observations of groundwater inflow rates during depth-specific sampling; and 2) depth-specific occurrences of field parameter measurements (and laboratory analyses for "second-step" monitor wells) that indicate the influence of mine-related groundwater (e.g., field measurements of specific conductance and pH, elevated sulfate and/or iron concentrations) or the presence of COCs that exceed MCLs. Nitrate and alkalinity may help identify the influence of irrigation practices on groundwater chemistry.

Construction Methods

All monitor wells would be constructed to allow for the collection of groundwater elevation measurements and groundwater quality samples. Monitor wells would be constructed with a nominal 15-foot long 6-inch diameter steel surface casing, and 2-inch diameter schedule 40 PVC tubing as the blank (i.e., not screened) portion of the well. Approximately three feet of the steel surface casing would stick up above the ground surface to protect the plastic tubing of the monitor well.

A 20-foot, 0.020-inch slotted screen constructed of schedule 40 PVC would be installed at the design interval. A 2-inch flush-threaded PVC end cap would be placed at the bottom of the screened interval. Where necessary, the borehole beneath the screen and bottom cap would be filled with bentonite grout (nominally 0.375-inch pellets).

A filter pack consisting of 10/20 silica sand would be placed against the well screen and would extend approximately 3 feet above the top of the screen interval (i.e., 23 feet of filter pack placed in the annulus). A 6-inch layer of finer filter-pack sand material would be placed on top of the coarser filter pack to limit bentonite intrusion. Bentonite would be used to fill the annular space above the fine filter sand to approximately 10 feet bgs. A 10-foot cement seal would then be placed in the annular space to the surface.

A locking 6-inch diameter well monument would be installed with a stick-up of approximately 3 feet above ground surface. A nominal 6-inch thick, 2-foot by 2-foot concrete slab would be placed around the surface casing. The well monument would contain the name of the monitor well with designations for shallow, intermediate or deep completions (e.g., B/W-10S and B/W-4D).

After the bentonite grout and cement surface seal has cured, each monitor well would be developed to remove fine-grained material from the well and to improve the hydraulic connection to the screened portion of the alluvial aquifer. Development procedures would include surging the well and periodically pumping or bailing of fine grained material until the turbidity of the discharge water is less than or equal to10 nephelometric turbidity units (NTUs) or has stabilized (i.e., varies less than +/- 10% over three successive casing volumes.

A Nevada-registered surveyor would be employed to survey the horizontal and vertical locations of each new monitor well, including the ground surface and top-of-casing elevations. The reference measurement point for taking depth-to-water measurements would be permanently marked on the top of the well casing, and would be surveyed within +/-0.01 foot in relation to mean sea level and to Nevada State Plane West Zone coordinates (NAD 27).

<u>Sampling of Monitor Wells</u>

Prior to water quality sampling, groundwater level measurements would be recorded for the new monitor wells. An electronic water level probe would be used to measure the depth to groundwater in each well to the nearest 0.01 foot from the surveyed points on the well casings (if measured prior to surveying, the measurement point would be clearly marked on the casing so that the reference measurement point can be correctly identified later by the surveyor). The depth-to-groundwater measurements would be recorded in a field logbook per the QAPP.

Prior to sampling, the groundwater quality monitoring probes/meters including pH, conductivity, temperature, DO and ORP would be calibrated daily in accordance with manufacturer's instructions. At a minimum, two-point calibrations would be conducted for pH and conductivity. The dissolved oxygen probe would be checked against a zero-dissolved oxygen solution. In addition, the dissolved oxygen calibration would be corrected for local barometric pressure and elevation. Calibration results would be recorded in a field logbook according to the QAPP.

The parameter suite for the groundwater samples would consist of: 1) field measurements of pH, conductivity, temperature, DO and ORP; and 2) laboratory analysis of the constituents listed in Table 5. After the initial sampling activities described in this Work Plan, the new monitor wells would then be included in the quarterly monitoring program performed by Atlantic Richfield (note that the analytical parameters presented in Table 5 may be modified pending further discussion with EPA). Groundwater samples would be collected from the newly installed monitor wells using low-flow (minimal drawdown) sampling procedures that are consistent with EPA guidance (EPA, 1996 and 2002), per the following procedures:

- The pumping system would be prepared for operation by connecting the tubing to the in-line water quality meter and lowering the pump and tubing into the well, with the intake positioned at the approximate middle of the well screen.
- Commence well purging by low-flow pumping from the well at a flow rate not to exceed 500 milliliters per minute (ml/min). Initially a flow rate between 200 and 500 ml/min would be used. Efforts would be made to minimize generation of air bubbles in the sampling tubing by either increasing the flow rate as appropriate, or restricting the flow by clamping the tube. The purge rate would be recorded in the field logbook or field sampling form.
- Ideally, drawdown in the well should not exceed 0.3 feet. Pumping rates should, if needed, be reduced to the minimum capabilities of the pump to help allow parameter stabilization.
- During purging, field parameters would be monitored and recorded including pH, conductivity, temperature, ORP and DO at time intervals sufficient to evacuate the volume of the flow-through cell, which would be calculated by dividing the volume of the flow-through cell by the pumping rate.
- Well sampling can commence after equilibration of water quality parameters. Equilibrated trends are generally obvious and usually follow either an exponential decay or asymptotic trend during purging.
- If the indicator field parameters have not stabilized after one hour of purging, then discontinue purging and collect the groundwater samples.

Equilibration is defined as three consecutive water quality parameter readings that meet the following EPA guidelines:

- Temperature +/- 3%
- pH +/- 0.1 Standard Units
- Conductivity +/- 3%
- ORP +/- 10 mV
- DO +/- 10%
- Turbidity +/- 10% when turbidity exceeds 10 NTUs.

Piezometers to be installed adjacent to pumpback wells PW-3 and PW-10 would be constructed in a similar fashion to that of the monitor wells, and their screen intervals would be consistent with the construction of the pumpback wells. No groundwater samples would be obtained from the piezometers. Continuous groundwater elevation measurements from the two piezometers would be obtained using a pressure transducer and data logger. A description of the Global Water WL 15 logger, proposed for use in the piezometers, is included in Appendix B.

<u>Sample Handling, Transport and Documentation</u>

Preparation of groundwater samples in the field for transport to the laboratory (including handling, labeling, packaging, documentation, shipment preparation and custodial quality control) would be conducted in accordance with the QAPP (Brown and Caldwell, 2003b). After field parameters have stabilized, a groundwater sample would be collected from the submersible pump installed in the well. The sample would be decanted into an appropriate sample container depending on the required analysis. Both filtered samples for dissolved constituents and unfiltered samples for total constituents would be each collected in 500-milliliter (mL) bottles. Samples for dissolved metals analysis would be filtered through a 0.45-micron filter.

Immediately after collecting the groundwater sample, nitric acid would be added to each dissolved or total metals sample container until the field pH measurement of the sample is less than 2 standard units. Non-metals samples would be collected in 1,000-mL bottles with no acid preservation. Immediately following collection, samples would be placed into an insulated cooler chilled with ice to an approximate temperature of four degrees centigrade. The samples would then be transported to the analytical laboratory via overnight mail or personal delivery. Sample containers, preservation methods, and filtering methods are summarized below.

Decontamination of purging equipment would be performed between the sampling of each monitor well by: 1) submerging and scrubbing the outside of the pump and associated hosing in an Alconox detergent bath; and 2) twice rinsing the inside of the pump in de-ionized water. At least five gallons of Alconox detergent solution followed by five gallons of de-ionized water would be used to rinse the internal portion of the pump.

Sample Identification and Preservation

Sample labels would be completed with a permanent marker and attached to each sample container prior to ground water collection. Strict attention would be given to ensure that each sample label corresponds to the collection sequence number marked on the bottle prior to sample collection. The labels would include the following information:

- Sample identification and type
- Sample date and time
- Sample preparation and preservative
- Analyses to be performed
- Person who collected sample

Each sample would be tracked according to a unique sample field identification number assigned when the sample would be collected. This field identification number consists of three parts:

- Sampling event sequence number
- Sampling location
- Collection sequence number

Blanks and duplicate samples for quality assurance would be labeled in the same fashion, with no obvious indication of their sample location or quality. Procedures for maximum holding times, storage conditions, and preservative method are presented below:

Sample Control Procedures

Parameter	Amount for Analysis	Container	Filtering	Maximum Hold Time	Storage Conditions	Preservatives
TDS	1,000 mL	1,000 mL HDPE	None	7 days	4°C	none
Sulfate	500 mL	1,000 mL HDPE	None	28 days	4°C	none
Nitrate	100 mL	1,000 mL HDPE	None	48 hours	4°C	H_2SO_4 to pH<2
Total Metals	Varies per metal	500 mL HDPE	None	6 months*	4°C	HNO_3 to pH<2
Dissolved Metals	Varies per metal	500 mL HDPE	0.45 µm	6 months*	4°C	HNO_3 to pH<2
Acidity/ Alkalinity	100/200 mL	500 mL HDPE	None	14 days	4°C	none

TDS= Total Dissolved Solids HDPE= High-density polyethylene ml=milliliters
HNO_3= Nitric acid H_sSO_t= Sulfuric Acid

The following sample preservation methods would be followed for collected groundwater samples:

- If the sample is to be analyzed for dissolved metals, filter sample through a 0.45-micron filter using an inline filter immediately after sample collection. After filtering, add nitric acid to the sample until the pH is less than 2.
- If the sample is to be analyzed for total metals, do not filter. Add nitric acid to the collected sample until the pH is less than 2.
- Check the pH by pouring a small amount of sample into the bottle cap and checking the pH with pH paper.
- Discard the liquid in the cap after checking the pH.
- Replace the cap, place the sample container in a sealed zip-loc plastic bag, and cool the sample to 4°C by immediately placing it in an insulated chest with containerized ice.
- Indicate on the sample label what the requested analysis is (e.g., dissolved or total).
- Observe the maximum holding times and storage conditions for all collected water samples.

Sample Handling and Transport

The QA objectives for the sample-handling portion of the field activities are to verify that decontamination, packaging and shipping are not introducing variables into the sampling chain which could render the validity of the samples questionable. In order to fulfill these QA objectives, blank and duplicate QC samples would be used as described below. Duplicate samples would be collected at a frequency of one in ten samples for each analysis. Duplicate samples would be collected by filling the bottles for each analysis at the same time the original sample is collected. Each sample from a duplicate set would have a unique sample number labeled in accordance with the identification protocol, and the duplicates would be sent "blind" to the lab (i.e., no special labeling of the duplicate would be provided).

A field sample would be designated as the "lab QC sample" at a frequency of 1 per 20 samples (including blanks and duplicates) for all parameters. The lab QC sample is the sample the laboratory would use for its internal quality control analyses. The lab QC sample for water analyses would be a double volume sample. The lab QC sample would be a sample that is representative of other contaminated samples. The sample containers and paperwork would be clearly labeled "Lab QC Sample".

A blank sample would be collected by pouring the blank water directly into the sample bottles at one of the sample locations. De-ionized water would be used for collecting blank water samples. Field blanks would be labeled in the same manner as other samples and would be sent "blind" to the lab, with no special indication of the nature of the sample.

Chain-of-custody protocol would be followed throughout the transport process. Each chain-of-custody would contain the following information:

- Project name
- Sampler's name and signature
- Sample identification
- Date and time of sample collection
- Sample matrix
- Number and volume of sample containers

- Analyses requested
- Filtration completed or required
- Method of shipment

The following sample packaging and shipment procedures would be followed for collected water samples to ensure that samples are intact when they arrive at the designated laboratory:

1. Place a custody seal over each container, and place each container in a zip-loc plastic bag and seal the plastic bag shut.
2. Place the sealed containers in the insulated ice chest.
3. If required, fill empty spaces in the ice chest with either ice, pelaspan (styrofoam popcorn), or bubble-pack wrap to minimize movement of the samples during shipment. Contained ice would be double bagged in zip-loc plastic bags to avoid water leakage.
4. Enclose the chain of custody form and other sample paperwork in a zip-loc plastic bag. If shipping the ice chest, tape the plastic bag to the inside of the ice chest lid. If self-transporting the ice chest, tape the plastic bag to the outside of the ice chest lid. Keep a copy of all paperwork.
5. Seal the ice chest shut with strapping tape and place two custody seals on the front of the cooler so that the custody seals extend from the lid to the main body of the ice chest. Place clear tape over each custody seal on the outside of the ice chest.
6. If shipping the ice chest, label it with "Fragile" and "This End Up" labels. Include a label on each cooler with the laboratory address and the return address.
7. Transport ice chests to the appropriate laboratory within 24 hours by hand-delivery or via express overnight delivery.

Laboratory Analyses and QA/QC

An EPA-certified laboratory would perform laboratory analyses. Criteria that are qualitative and quantitative indictors of laboratory data quality are precision, accuracy, representiveness, completeness and comparability, as described below:

- Precision is a measure of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions (usually expressed in terms of the relative percent difference or standard deviation).
- Accuracy is the degree of agreement of a measurement with an accepted reference or true value. Usually expressed in terms of percent recovery.

- Representiveness refers to a sample or group of samples that reflects the characteristics of the media at the sampling point. It also includes how well the sampling point represents the actual parameter variations.
- Completeness describes the amount of valid data obtained from a series of measurements relative to the amount anticipated to achieve the DQOs for this Work Plan.
- Comparability expresses the confidence with which one data set can be compared to another. Data comparability can be ensured by reporting each data type in consistent units (e.g., all field measurements would be reported in consistent units and analytical methods would be similar or equivalent for all rounds of sampling). Comparability and representiveness are also ensured by the use of established field and laboratory procedures and their consistent application.

Documentation

Summary of field measurement and sampling activities would be recorded in a field notebook with integral bound pages, and entries would contain accurate and inclusive documentation of project activities in objective and factual language. Entries would be made using permanent waterproof ink, and erasures are not permitted. Errors would be single-lined out, should not be obscured, and initialed and dated. The person making the entries would sign at the beginning and the end of the day's entries, and a new page would be started for each day. The following entries would be made to the bound site logbook and/or filed log sheets:

- General descriptions of weather conditions
- Location of each sampling point
- Data and time of sample collection (field log sheets.)
- The type of blank collected and the method of collection
- Field measurements made, including the date and time of measurements
- Calibration of field instruments
- Reference to photographs taken
- Date and time of equipment decontamination
- Field observations and descriptions of problems encountered
- Duplicate sample location

3.3 Site Job Safety Analysis

A site-specific Job Safety Analysis (JSA) is presented in Appendix D. This JSA has been prepared in the context of the revised Health and Safety Plan (SHSP) for the Yerington Mine Site (Brown and Caldwell, 2004). The SHSP identifies, evaluates and prescribes control measures for health and safety hazards, including radiological hazards, and describes emergency response procedures for the site. SHSP implementation and compliance would be the responsibility of Atlantic Richfield's contractor, with Atlantic Richfield taking an oversight and compliance assurance role.

Changes or updates would be the responsibility of the contractor with review by Atlantic Richfield Safety Representative Lorri Birkenbuel. Copies of the SHSP are located at the site, in Atlantic Richfield's Anaconda office, and in the contractor's office. The SHSP includes:

- Safety and health risk or hazard analysis;
- Employee training records;
- Personal protective equipment (PPE);
- Medical surveillance;
- Site control measures (including dust control);
- Decontamination procedures;
- Emergency response; and
- Spill containment program.

The SHSP includes a section for site characterization and analysis that would identify specific site hazards and aid in determining appropriate control procedures. Required information for site characterization and analysis includes:

- Description of the response activity or job tasks to be performed;
- Duration of the planned employee activity;
- Site topography and accessibility by air and roads;
- Safety and health hazards;
- Hazardous substance dispersion pathways; and
- Emergency response capabilities.

All contractors would receive applicable training, as outlined in 29CFR 1910.120(e) and as stated in the SHSP. Site-specific training would be covered at the briefing, with an initial site tour and review of site conditions and hazards. Records of pre-entry briefings would be attached to the SHSP. Project tasks and associated potential hazards are summarized below.

Project Tasks and Associated Potential Hazards, Yerington Mine Site	
Sequence of Basic Job Steps	**Potential Hazards**
Well/Piezometer installation: drilling rig mobilization and setup	▪ Traffic and pedestrian mishaps and resulting bodily injury. ▪ Drilling into underground utilities. ▪ Striking overhead lines or objects with drill mast. ▪ Physical hazards associated with handling and transferring fuel to machinery. These include ignition/explosion, dermal irritation, inhalation of fumes, accidental ingestion, and eye contact.
Well/Piezometer Installation: drilling activities	▪ Injury to hearing from noise. ▪ Inhalation hazards from dust from drilling activities. ▪ Physical injury from moving parts of machinery. ▪ Physical hazards to personnel on the ground in the vicinity of the heavy machinery.
Well/Piezometer Installation: construction	▪ Inhalation of silica sand, bentonite, or concrete dust. ▪ Eye injury or irritation from splashing ground water. ▪ Physical hazards associated with use of hand tools to tighten or loosen augers.
Surveying	▪ Traffic and pedestrian mishaps and resulting bodily injury. ▪ Lightning.
Collect Monitor Well Field Parameter Measurements	▪ Skin irritation from dermal or eye contact. ▪ Slipping or falling on wet ground surface.
Purge Monitor Wells	▪ Skin irritation from dermal or eye contact. ▪ Slipping or falling on wet ground surface.
Prepare sample bottles and dress in appropriate PPE.	▪ Burn or corrosion from acid spillage, if sample bottles do not have acid already in them.
Collect Ground Water Samples and Decontaminate Equipment	▪ Skin irritation from dermal or eye contact. ▪ Slipping or falling on wet ground surface.
Package and Transport Groundwater Samples to Laboratory	▪ Traffic and pedestrian mishaps and resulting bodily injury.
All Activities	▪ Slips, Trips, and Falls. ▪ Back, hand, or foot injuries during manual handling of materials. ▪ Heat exhaustion or stroke. ▪ Hypothermia or frostbite.
Unsafe conditions.	▪ All potential hazards.

Elements to be covered in site-specific training include: persons responsible for site-safety, site-specific safety and health hazards, use of PPE, work practices, engineering controls, major tasks, decontamination procedures and emergency response. Other required training, depending on the particular activity or level or involvement, must include OSHA 40-hour training and annual 8-hour refresher courses. Other training may include, but is not limited to, competent personnel training for excavations and confined space. Copies of site personnel OSHA certificates would be attached to the SHSP.

JSAs for this Work Plan incorporate individual tasks, the potential hazards or concerns associated with each task, and the proper clothing, equipment, and work approach for each task. Given that potential radiological hazards may exist both on and off the mine, the JSAs and the updated version of the SHSP addresses this concern. Copies of Training Certificates for all site personnel would be attached to the SHSP. Personnel would initially review the JSA forms at a pre-entry briefing.

SECTION 4.0

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